US Environmental Protection Agency
Region 2

Berry's Creek Study Area Proposed Plan

Part of the Ventron/Velsicol Superfund Site **May 2018**

PURPOSE OF THIS PROPOSED PLAN

This Proposed Plan describes remedial alternatives considered for: (1) sediments of the Upper and Middle Berry's Creek waterways and their associated tributaries; and (2) the marsh sediments in Upper Peach Island Creek. It also identifies the preferred remedial alternatives with the rationale for this preference. The Berry's Creek Study Area (BCSA) is Operable Unit 2 (OU2) of the Ventron/Velsicol Superfund Site.

This Proposed Plan was developed by the U.S. Environmental Protection Agency (EPA), in consultation with the New Jersey Department of Environmental Protection (NJDEP). In addition, EPA has consulted with the National Oceanic and Atmospheric Administration (NOAA) and U.S. Fish and Wildlife Service (USFWS). EPA is issuing the Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The nature and extent of the contamination in the BCSA and the remedial alternatives summarized in this Proposed Plan are described in greater detail in two documents, the *Remedial Investigation Report, Berry's Creek Study Area* (RI Report) and the *Feasibility Study Report, Berry's Creek Study Area* (FS Report). These and other documents are part of the publicly available administrative record file and are located in the information repository for the Site. EPA encourages the public to review these documents to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted at the Site.

The findings of the RI Report support an adaptive, multi-phased approach to remediating

MARK YOUR CALENDAR

Public Comment Period:

May 2 to June 6, 2018

EPA will accept written comments on the Proposed Plan during the public comment period. Written comments should be addressed to:

Doug Tomchuk
Remedial Project Manager
US Environmental Protection Agency
290 Broadway, 19th Floor
New York, New York 10007-1866

Or e-mail: tomchuk.doug@epa.gov
Please include subject line:
BCSA Public Comment

Public Meeting
EPA will hold a public meeting to explain the Proposed Plan and all the alternatives presented in the Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held:

Wednesday May 9, 2018
6:30 to 8:30 PM

Little Ferry Public Library
239 Liberty Street - Little Ferry, NJ 07643

A poster session will start at 6:30 pm and a formal presentation be held from 7:00 to 8:30 pm.

EPA's website:
www.epa.gov/superfund/ventron-velsicol

Additional information:
http://berryscreekstudyarea.com

contamination in the BCSA. The initial phase of cleanup, described in this Proposed Plan, addresses the sediments in the northern portion of the BCSA that present the highest risk, and act as a source of contamination to the wetlands and other segments of the BCSA. This source control action will be an interim action for the BCSA (the "Phase 1 interim remedial action"). The FS Report evaluated remedial alternatives for the source control interim remedial action. EPA's preferred alternative for the northern portion of the BCSA (the "Phase 1 area") includes two major elements:

1) In Upper Berry's Creek (UBC) and Middle Berry's Creek (MBC) waterways, dredging of 2 feet of soft sediment or to consolidated clay, if soft sediment is less than two feet, with placement of clean backfill/cap over remaining soft sediment to return to original elevation; and

2) In Upper Peach Island Creek (UPIC) Marsh, removal of 1 foot of sediment and placement of 1 foot of clean backfill/cap over most of UPIC marsh, with 2 feet of sediment removal and backfill/cap within 10 feet of the waterways, and a thin-layer cover in the area of the radio towers.

Sediment removed from the UBC and MBC waterways and UPIC marsh will be dewatered, treated, and transported for off-site disposal. The estimated cost of the preferred remedy is $332 million. The existing fish and crab consumption advisories (issued by NJDEP and New Jersey Department of Health (NJDOH)) would remain in place and additional institutional controls (*e.g.*, property use and access restrictions) would be implemented as part of the Phase 1 interim remedial action. Monitoring would be conducted to evaluate the performance of the Phase 1 interim remedial action, as well as the associated response of the marshes and the waterways outside of the Phase 1 area to the post-remedy conditions. The data generated through the performance monitoring program will support the evaluation of additional remedial action(s) for the BCSA in the future. Included in the monitoring program will be a Marsh Demonstration Project which will evaluate potential remedial options for the marshes, as well as monitor the response of the marshes to the waterway remediation.

EPA in consultation with NJDEP, may modify the preferred alternative or select another alternative presented in this Proposed Plan based on new information and public comments. The final decision regarding the selected remedy will be made after EPA has taken into consideration all public comments. EPA is soliciting comment on all the alternatives considered because EPA may select a remedy other than the preferred remedy.

Site Description

The Berry's Creek watershed is located in the Hackensack River Meadowlands in Bergen County, New Jersey (Figure 1). Portions of the creek are located in the Boroughs of Teterboro, Moonachie, Wood-Ridge, Carlstadt, Rutherford and East Rutherford. The 12-square mile (mi^2) watershed consists of approximately 1.6 mi^2 of tidal waterways and marshes (the "tidal zone"), and 10.4 mi^2 of highly-urbanized upland areas that drain to the BCSA tidal zone (Figure 2).

The area surrounding Berry's Creek and the marshes have multiple uses. Most of the adjacent areas are commercial or light industrial, part of the New Jersey Sports and Exhibition Authority (NJSEA) stadium complex, or roadways. Teterboro Airport is in the northern portion of the watershed, located between the East and West Risers (which are two of the major tributaries to Berry's Creek). There are several closed municipal landfills in the southern portion of the BCSA. In addition, in Upper Peach Island Creek Marsh is a group of eight large radio towers. There is limited residential use bordering the creek and marshes, however, in areas of higher elevation there is a high density of residential use.

The RI focused on the tidal zone and contamination in BCSA waterways and marshes associated with past releases of hazardous substances to the creek. The waterways include the main channel of Berry's Creek, which is an approximately 4.5-mile long tidal tributary of the Hackensack River, and the numerous tributary channels that flow into the main channel. The BCSA includes roughly 756 acres of common reed (*Phragmites australis* (*Phragmites*)) marshes along the tidal waterways plus UPIC marsh—an area that was formerly tidal marsh, but is now separated from routine tidal exchange by the Peach Island Creek (PIC) tide gate.

For purposes of the site investigations and remedy selection process, the BCSA has been operationally divided into five geographic study segments (see Figure 1) segregated by infrastructure and/or

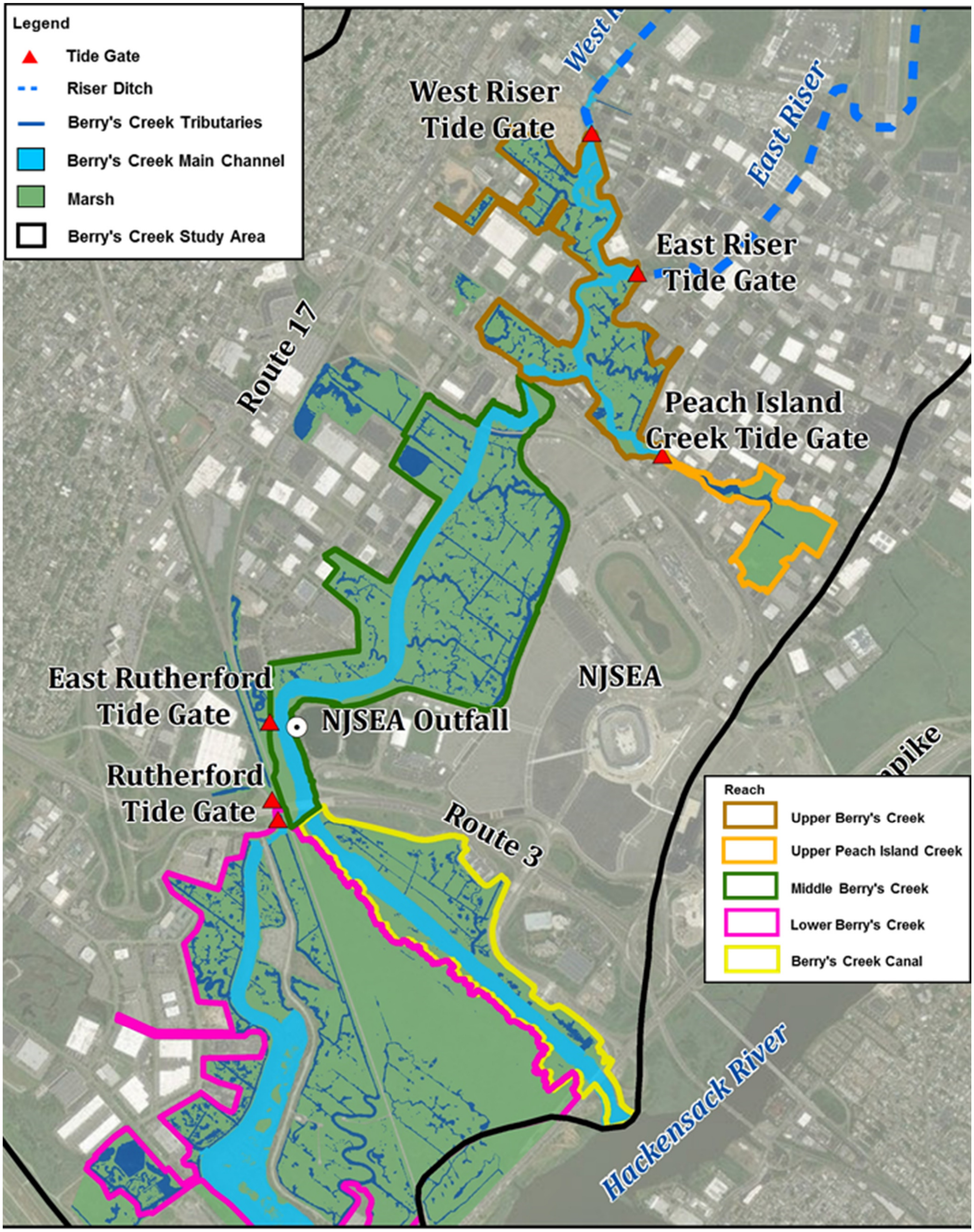

Figure 1. Site map with study segments

confluences with other waterways, and includes the section of the creek described as well as the associated tributaries and marshes:

- Upper Berry's Creek: extends from the West Riser tide gate south to Paterson Plank Road;
- Middle Berry's Creek: extends from Paterson Plank Road south to Route 3;
- Berry's Creek Canal (BCC): constructed in 1911, extends from Route 3 to the Hackensack River;
- Lower Berry's Creek (LBC): extends from MBC and BCC at its northern end through culverts near Route 3 to the Hackensack River at its southern end; and,
- Upper Peach Island Creek (UPIC): The reach of Peach Island Creek located above the Peach Island Creek tide gate.

An overall trend of decreasing contaminant concentrations is observed from north to south across the BCSA. The industrial sources of chemicals of concern (COCs) in UBC and MBC were largely removed or controlled in the 1970s to early 1980s, and sewage effluent discharges were removed from the BCSA by the early 1990s. Some typical urban pollution sources remain, such as runoff from roads, unpermitted oil dumping to stormwater collection systems, permitted discharges, and atmospheric deposition.

Site History

At the time that significant human settlement of the BCSA began, the system was predominately an Atlantic white cedar swamp. The BCSA was essentially a freshwater creek with fringing wetlands that fed into the Hackensack River. Beginning in the17th century, the Atlantic white cedar forest was cut and burned extensively. Trenches that were dug to mark property boundaries and to drain land for mosquito control, agriculture, and development significantly altered the local hydrology. However, maps in the 19th century still show the BCSA area as containing a significant cedar swamp.

The largest recent change in the system resulted from the construction of the Oradell Dam in 1902. The dam substantially reduced the flow of freshwater from the upper Hackensack River watershed into the estuary. The dam construction was closely followed by the construction of the East and West Riser tide gates in the northern end of the BCSA watershed and the dredging of BCC in 1911, which created a deep straight channel directly connecting MBC and UBC with the Hackensack River and essentially bypassing LBC. Combined with the dredging of the Hackensack River in the lower portion of the estuary, the major anthropogenic (man-made) changes in the early 20th century facilitated encroachment of brackish water into the estuary and caused major habitat transitions driven by increases in the amount of salt water (salinity) in both the estuary and the BCSA. Within approximately 20 years of completion of the Oradell Dam, cattails, wild rice, and other freshwater wetlands plants were replaced by the more salt-tolerant common reed (*Phragmites*).

Through the first half of the 20th century, land development within the BCSA was largely constrained to the upland perimeter along established roadways. Development and landfilling activities in the latter part of the 20th century resulted in extensive filling of wetlands in the BCSA (more than 60 percent reduction), which altered the hydrology and salinity of the system. Further, along with development came chemical inputs to the system from the full range of land uses. Sources of chemical stressors to the BCSA, including industrial discharges, landfills, and other unpermitted discharges, have all impacted water and sediment quality in the BCSA. Waste disposal practices, particularly sewage discharges to the BCSA and the Meadowlands in general, also had detrimental effects on surface water dissolved oxygen concentrations and the aquatic community throughout the 20th century. By the 1970s, five sewage treatment plants discharged untreated or minimally-treated sanitary and industrial wastewater directly to the BCSA.

Today, the upland watershed is more than 90% developed and comprised of a mixture of residential, commercial, industrial, and transportation uses. There are three Superfund sites within the watershed: Scientific Chemical Processing (SCP), Universal Oil Products (UOP), and Ventron/Velsicol. As noted previously, the BCSA is being addressed as Operable Unit 2 (OU2) of the Ventron/Velsicol site. In addition, numerous other known contaminated sites, landfills, sewage treatment plants, historical and ongoing permitted and unpermitted industrial discharges, urban runoff, and suspended solids entering from the Hackensack

River have contributed to the contaminated conditions in the BCSA.

Investigations of Berry's Creek water quality occurred as early as the 1930s, to evaluate the effects of sewage discharges to the system. Subsequent investigations of water, sediment, and wildlife have been conducted since the 1970s, and identified polychlorinated biphenyls (PCBs), mercury, and other metals as contaminants of potential concern. The BCSA Remedial Investigation and Feasibility Study (RI/FS) was initiated in 2008 and a Record of Decision (ROD) is anticipated to be issued in 2018, based on this Proposed Plan.

SITE CHARACTERISTICS

The BCSA Site has been methodically evaluated through the RI/FS investigations. More than 10,000 samples were collected and analyzed over a seven-year period. The results of these studies are detailed in RI and FS Reports. The major processes controlling contaminant fate and transport in the BCSA are illustrated in the conceptual site models (see Figure 2), and discussion below.

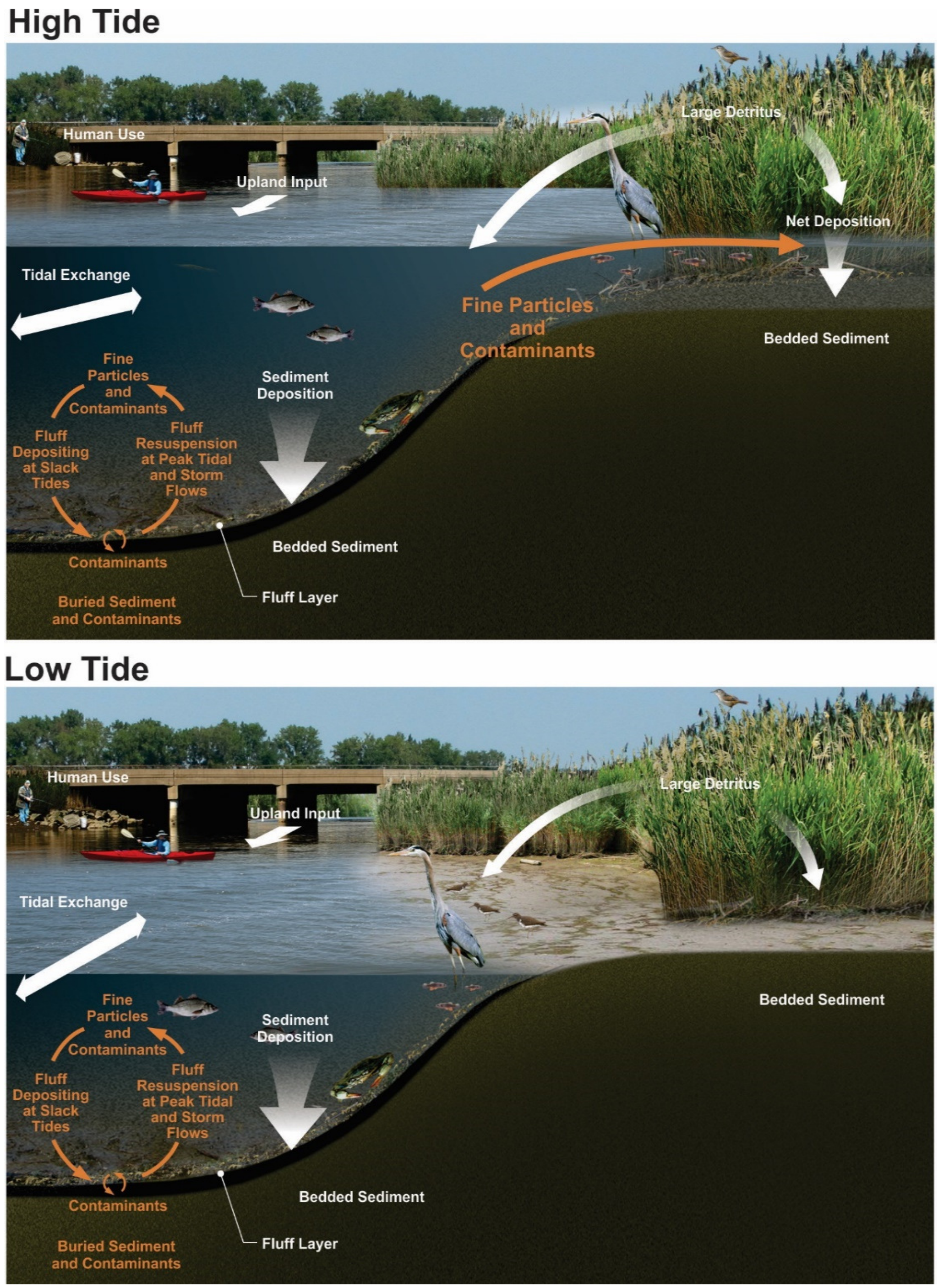

Figure 2. Conceptual site model of water and sediment dynamics at high tide and low tide, as well as potential human health and ecological risk receptors, for the Berry's Creek waterways and marshes.

Physical Characteristics

Berry's Creek is a side embayment of the larger Hackensack River estuary, and the river exerts an important influence on physical, chemical, and biological conditions in the BCSA. Consistent with the typical functioning of a fringing marsh system, the BCSA tidal zone is a stable setting and favors the accumulation of sediment carried into the tidal zone by tidal exchange with the Hackensack River and by water flowing from upland tributaries.

Freshwater inputs into the BCSA are relatively low, in comparison to the tidal exchange with water from the Hackensack River. Surface water velocities are low throughout the system most of the time and are governed by the routine rise and fall of the tides diurnally (twice daily). Although episodic storm flows can create higher velocities in the waterways, these effects are localized (*e.g.*, in pool areas and main channels) and of short duration. In other words, most of the sediment bed is only minimally disturbed even in high flow events, as evidenced by monitoring before and after Hurricane Irene (2011), Tropical Storm Lee (2011) and Superstorm Sandy (2012). The overall condition supports a stable sediment bed where particulate material depositing from the water column accumulates over time. This stability is exemplified in the mudflats, where the accumulation of sediment occurs consistently.

The BCSA waterways are also bounded by natural features, including expansive mudflats and marshes, that dissipate flow energies and encourage deposition. This means that as the tides reach the mudflats and marshes, they lose energy and can no longer carry the particulate material. Therefore, the particulate material settles out and is deposited in the mudflats and marshes. The result is an accumulation of a "soft sediment" surface layer throughout the waterways and marshes that overlies a more consolidated sediment layer. The consolidated layer was deposited during pre-industrial times, and sampling within the consolidated clay does not indicate downward movement of contamination. The consolidated layer is also not easily eroded. The soft sediment is dominated by fine-grained silts and clays, as well as organic materials derived primarily from detritus (decaying plant fragments) from the *Phragmites* marshes in the BCSA and the larger estuary. The overall low permeability of soft fine-grained sediments limits the movement of water within the soft sediment layer, which also limits the movement of contaminants that preferentially adhere to particles in the water. Mechanisms such as tidal pumping (the movement of water from higher elevations to lower elevations as the tide recedes) are limited by the low permeability of the fine-grained soft sediment in the BCSA. In addition, movement of water and contaminants from the sediment into the overlying water column is minimal at the BCSA because the marshes and waterways are located over a large clay formation (from a glacial lake), which effectively prevents the movement of groundwater.

The higher elevation of the marshes and the presence of dense *Phragmites* stands with root structures which typically extend more than one-foot in depth provide physical stability to the BCSA landscape by stabilizing the waterway banks, dissipating energy within the system, and facilitating deposition and retention of sediment throughout the marshes. Except for some small non-contiguous sections, the physical characteristics of the waterways have been stable for decades throughout most of the BCSA. This stable condition is projected to remain into the future.

Nature and Extent of Contamination

It was clear from early data collections in the RI/FS that the primary contaminants of potential concern (COPCs) for the BCSA were mercury, methyl mercury and PCBs. These COPCs are responsible for most of the risk in the BCSA, so subsequent sampling activities focused on these chemicals. Mercury, methyl mercury and PCBs are the primary contaminants of concern (COCs) for the BCSA. Most, if not all, of the COCs are co-located, so actions to address the primary COCs will also address other contaminants that may be present in the BCSA, but do not present an actionable risk. Distribution of COCs in BCSA media are presented in the RI Report. The range of concentrations of primary COCs (plus chromium) are found on Table 1, below.

Sediment

The distribution of COCs in BCSA sediment reflects the contribution of historical sources to the BCSA tidal zone and surrounding watershed, the physical characteristics that control water flow and sediment

Table 1. Median waterway surface sediment concentrations (mg/kg) by reach. Upstream (north) on left. Reference includes data from Bellman's Creek, Mill Creek, and Woodbridge River.

Contaminant of Concern	Median Waterway Surface Sediment Concentrations by Reach (mg/kg)					
	UPIC	UBC	MBC	BCC	LBC	Reference
Mercury	87	43	18	5.9	3.5	1.3
Methyl Mercury	0.026	0.023	0.013	0.012	0.006	0.003
Total PCBs	2.5	1.5	1.2	0.54	0.49	0.2
Chromium	570	329	244	161	161	43.3

transport within the BCSA, the interactions of the BCSA with the Hackensack River, and the chemical characteristics of the COCs, most notably their strong association with the solid particles and particulate organic carbon (POC) derived primarily from the marshes. In other words, the COCs are most likely to be bound to the high organic particulate material (such as the detritus) and move where the particulate material moves. COC concentrations generally exhibit a north to south decreasing gradient, with surface sediment concentrations higher in UPIC, UBC, and MBC as compared to the lower reaches (BCC and LBC) (Figure 3).

Deposition of the highest concentrations of mercury, PCBs and other contaminants occurred when historical industrial discharges were at a maximum (1950s and 1960s). Subsequent burial by progressively cleaner sediment over time has resulted in the highest concentrations of these COCs typically being present at depth in the vertical sediment profile. This process has resulted in considerable reduction in COC concentrations in surface sediment in both the waterways and the marshes; however, concentrations remain elevated in waterway surface sediment in UBC (including UPIC) and much of MBC. COC concentrations in the lower system (BCC, LBC) are more like the regional conditions.

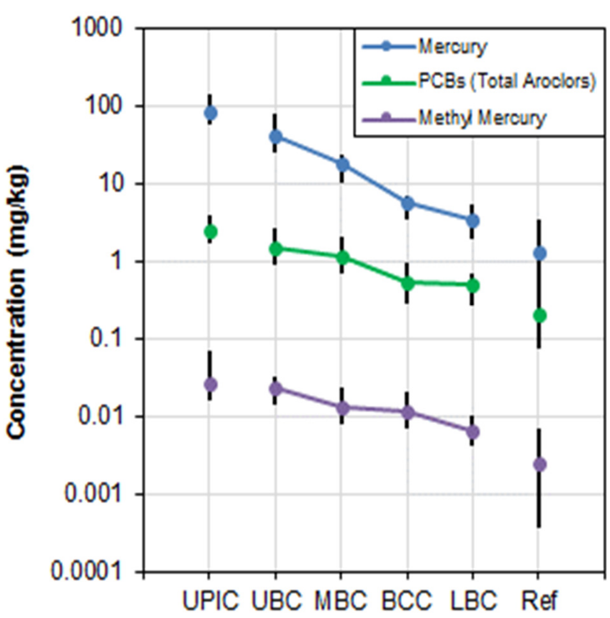

Figure 3. Concentrations in Waterway Surface Sediment (median, 25th, and 75th percentiles; mg/kg = milligram per kilogram), Upstream (North) on Left

Natural recovery can occur at sediment sites through various processes. At the BCSA, the prominent natural recovery process that occurs is the decrease in contaminant concentrations at the point of potential exposure (*e.g.*, surface of sediment) over time as cleaner sediment is deposited on the surface. The pattern of natural recovery in BCSA sediment is evident due to the higher concentrations of COCs at depth as compared to surface sediments measured in waterways and marshes throughout much of the BCSA. However, some exceptions to the pattern of natural recovery include: localized areas in the tidal zone waterways where peak flows are more variable; UPIC marsh where the highest COC concentrations occur closer to the sediment surface compared to sediment in the tidal marshes; and for methyl mercury, the concentration of which is strongly influenced by environmental conditions that impact how mercury is converted to methyl mercury.

Contamination near the sediment surface is a concern because it is within the biologically active zone and is therefore more available for uptake by biota than more deeply buried contamination. The COC concentrations in the sediments near and at the surface of the waterways are the product of a variety of mechanisms, including, among other things, ongoing deposition to the sediment bed and episodic redistribution of shallow sediment in localized areas during large storm events. COC concentrations in marsh near-surface sediment reflect movement of COCs that are bound to particles from the waterways into the marshes. Continuing deposition of COC-contaminated particles from the waterways results in slower recovery rates in the marshes than might otherwise be observed.

Surface Water

The majority of the COCs identified in the BCSA strongly adsorb to the particulate matter suspended in surface water. Suspended particulates in BCSA surface water have high organic content because of the P*hragmites* detritus from the surrounding marshes, as well as the organic material that is present in the water that enters the creek from the Hackensack River through tidal exchange. The particulates routinely settle onto, interact with, and resuspend from the surface of the waterway sediment bed because of fluctuations in tidal and storm velocities. These processes support the presence of a thin (~0.2 inch) layer of unconsolidated, high organic content material on the surface of the sediment bed in the waterways. This easily resuspended layer is commonly referred to as the "fluff layer." The presence of a fluff layer is typical in estuarine systems. Although the fluff layer contains substantially more solids particles than the water column above it, the fluff layer behaves more like the surface water than the surficial soft sediments. Interaction of the fluff layer with the surface of the waterway sediment bed is an important mechanism for COCs to be transported from waterway sediments to surface water and, in turn, for COCs to be taken up by organisms and transported elsewhere, where they can accumulate in the tissues of biota. The suspended particulate matter and associated COCs are transported into the marshes during high tides, where a portion of the particulates are deposited and retained on the marsh surface and contribute to marsh surface sediment COC concentrations.

Biological Uptake of COCs

Mercury, methyl mercury, and PCBs have been detected in biota collected in BCSA waterways and marshes, with higher concentrations in biota from UBC and MBC and lower concentrations in biota from BCC and LBC (see Figure 4).

The food web in the BCSA is primarily detritus based. This means that detritus, which predominantly originates from decaying *Phragmites* leaves and stems, serves as the primary source of energy to biota within the system. As the *Phragmites* leaves and stems grow, they do not uptake significant amounts of COCs. However, as the stems and leaves die, they generally fall to the marsh surface, where they can contact contaminants as the tide brings in contaminated particles from the waterways. In time, the *Phragmites* stems and leaves become the detritus that exits the marshes with the receding tides. Once in the waterways, a portion of the detritus will settle to the sediment surface, where it becomes part of the fluff layer or is incorporated into the surface sediments. Because the detritus is composed almost entirely of organic matter, the COCs readily adsorb to it from the surface sediments.

Shrimp, fiddler crab, and other organisms feeding on detritus and other organic matter provide the dietary link between the detritus and fish and other consumers. Thus, COC concentrations in the detritus entering the food web are linked to the COC concentrations at the surface of the waterway sediment bed. In marshes, exposure to COCs is

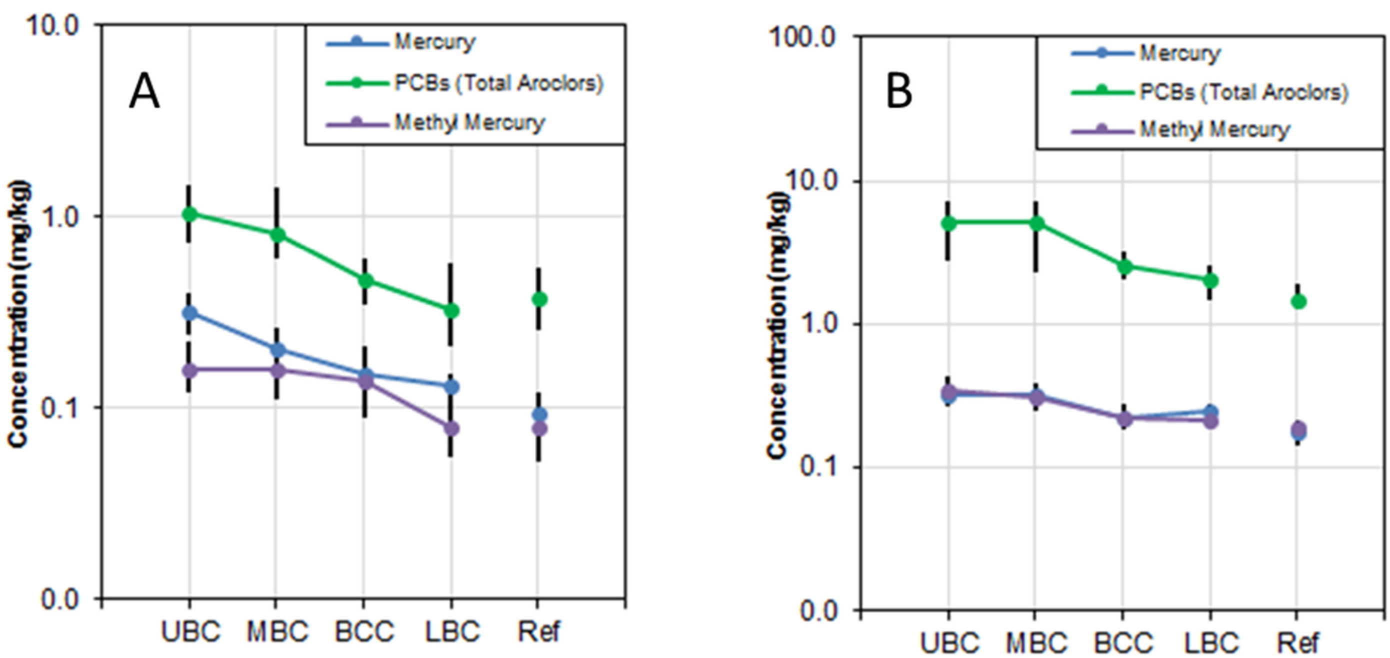

Figure 4. COC Concentrations in Mummichog (A) and Whole Body White Perch (B) (median, 25th, and 75th percentiles), Upstream (North) on Left

limited primarily to the detrital layer on the marsh surface, where most of the biological activity is concentrated. Marsh invertebrates and other organisms feeding on or in the detrital layer can be exposed to COCs and COCs have been detected in invertebrates collected from the BCSA marshes. As stated earlier, particulates transported from the waterway are an important source of COCs present in marsh detritus. Overall, the COC concentrations in marsh detritus and the waterway near-surface sediment are reflected in the COC concentrations in BCSA organisms.

Bioavailability (how readily COCs can be taken up into the tissue of organisms) is controlled by many factors in the BCSA. The bioavailability of the primary COCs in the BCSA is largely controlled by partitioning to organic matter, complexation with sulfides, as well as the burial of COCs by cleaner sediment. The understanding of bioavailability is important in the BCSA because even though the concentrations in some biota present unacceptable risk, the levels are significantly less than might be anticipated based on the high COC concentrations present in the sediments.

SCOPE AND ROLE OF THE ACTION

The BCSA is being addressed by EPA through an adaptive, multi-phased cleanup approach. Although the RI Report included investigations that were developed for the entire BCSA, it became clear during the process that the sediments in Upper and Middle Berry's Creek are:

- the areas of highest contaminant concentrations at the surface[1] of the sediment,
- the primary source of exposure and risks from the COCs, and
- the on-going source that contributes to surface contamination in the tidal marshes and downstream segments (LBC and BCC) as a result of fine sediment resuspension and transport in surface water.

Despite rigorous efforts to characterize the BCSA, uncertainties regarding the transport of contaminants from the waterways to the marshes make it premature to select a remedy for the tidal marshes until the effectiveness of the waterway cleanup can be evaluated. Therefore, in June 2016, EPA requested that the Berry's Creek Study Area Group evaluate alternatives to remediate the waterway sediments in UBC and MBC as an interim, source-control action. In addition, the high contaminant concentrations in the surface sediments of UPIC Marsh would be addressed because concentrations in the surface water in UPIC were among the highest recorded at the BCSA, and therefore it was appropriate to address the UPIC source area at the same time as UBC and MBC. This approach is consistent with EPA policy and practice to address sources first. It should be noted that the upland facilities (*e.g.*, Ventron/Velsicol (OU1), etc.) that were the initial sources of contamination to the BCSA have mostly been or are being addressed through separate actions. The Phase 1 interim remedial action is considered "interim" because one or more additional remedies will need to be selected in the future, as described below.

Uncertainties remain regarding both the response of the BCSA system to potential remedial actions and the mechanisms that contribute to exposure, risks, and the rate of natural recovery in the BCSA marshes. To address these uncertainties in a planned and systematic way, an adaptive management approach will be used to (a) promote intentional learning during the design and implementation of the Phase 1 interim remedial action to respond to changes and new information and ensure the remedy achieves the objectives, (b) collect and evaluate additional information to reduce uncertainties associated with the recovery of the marshes and downstream segments resulting from source removal, and (c) support evaluation and selection of further remedial actions. EPA expects that additional risk assessments and one or more Supplemental Feasibility Studies and decision documents will be developed following completion of these activities to address the remainder of the BCSA. The multi-phased remedy approach is illustrated in Figure 10 on the last page of this Proposed Plan. Because the subsequent and final remedial action for the BCSA will be developed based on these evaluations that rely in part on the results of the Phase 1 interim remedial action, this interim action will necessarily be consistent with those future actions.

Implementation of this initial phase would (a) reduce exposure of birds, fish, crabs, people (via ingestion of fish or crabs) and other biota to COCs in sediment

[1] Surface sediments in the BCSA were defined by field observations as 6 centimeters (cm) (2.4 inches) in UBC and 10 cm (4 inches) in the rest of the BCSA.

What is Human Health Risk and How is it Calculated?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate the hazardous substances under current- and future-land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the chemicals of potential concern (COPCs) at the site in various media (for Berry's Creek, sediment, surface water, air and tissue) are identified based on such factors as toxicity, concentration and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the COPCs in the various media identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated surface water and sediment. Factors relating to the exposure assessment include, but are not limited to, the concentrations in specific media that people might be exposed to and the frequency and duration of that exposure. Using these factors, a "reasonable maximum exposure" scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated. A "central tendency exposure" scenario, which portrays the average or typical level of human exposure that could occur, is calculated when the reasonable maximum exposure scenario results in unacceptable risks, as discussed below under *Risk Characterization.*

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other noncancer health hazards, such as changes in the normal functions of organs within the body (*e.g.*, changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and noncancer health hazards.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks for all COPCs. Exposures are evaluated based on the potential risk of developing cancer and the potential for noncancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a "one-in-ten-thousand excess lifetime cancer risk;" or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions identified in the Exposure Assessment. Current Superfund regulations for exposures identify the range for determining whether remedial action is necessary as an individual excess lifetime cancer risk of 10^{-4} to 10^{-6}, corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk. For noncancer health effects, a "hazard index" (HI) is calculated. The key concept for a noncancer HI is that a threshold (measured as an HI of less than or equal to 1) exists below which noncancer health hazards are not expected to occur. The goal of protection is 10^{-6} and an HI of 1 for a noncancer health hazard. Cumulative risks that exceed a 10^{-4} cancer risk or an HI of 1 require remedial action at the site.

and (b) prevent these sediments from being an ongoing source of contaminants to the adjacent marshes and downstream areas. Future phases of work will consider the extent to which this initial phase reduced risk in the BCSA waterways and reduced uncertainty regarding the extent of risk and the of natural recovery in the BCSA marshes and downstream areas, taking regional conditions affecting the BCSA into account.

PRINCIPAL THREAT WASTE

Although mercury, PCBs and methyl mercury in sediment act as a source to surface water contamination and to the biota, these sediments are not highly mobile and can be reliably contained, so they are not considered principal threat wastes at the BCSA. Although some concentrations of the COCs are high, the exposure point concentration, the statistical value calculated to represent a reasonable maximum exposure to both human and ecological receptors, results in risks that exceed acceptable levels but do not meet the principal threat waste threshold.

SUMMARY OF SITE RISKS

Baseline human health and ecological risk assessments were conducted for the Site to estimate the risks associated with exposure to contaminants based on current and likely future uses of the BCSA. These baseline risk assessments are detailed in Appendix L and Appendix M of the RI Report.

Baseline Human Health Risk Assessment

A Baseline Human Health Risk Assessment (BHHRA) was conducted to assess the cancer risks and non-cancer health hazards associated with exposure to COCs present at the Site. The risk assessment was conducted using the standard EPA risk assessment process comprised of Hazard Identification, Exposure Assessment, Toxicity Assessment, and Risk Characterization (see adjacent text box).

People can be exposed to COCs present within the BCSA in air, surface water, sediment, crabs, and fish, through a variety of activities that are consistent with current and potential future uses of the BCSA. There are no residences within the marshes along Berry's Creek and the dense stands of *Phragmites* limit use by people. Recreational use of Berry's Creek waterways is the main way that people are exposed to COCs. These recreational uses may include fishing, crabbing, and kayaking/canoeing/boating. Fishing and crabbing activities are focused in and around the creek in areas that are readily accessible from roads. Construction workers conducting routine inspections or maintenance activities related to road, bridge, or rail infrastructure may also be exposed to COCs. For each assumed use, a reasonable maximum exposure (RME), which uses conservative exposure values, was evaluated to estimate cancer risks and non-cancer hazard.

The estimated cancer risks for all potential exposure pathways calculated using the RME are within EPA's acceptable risk range (less than 1×10^{-4}). Estimated cancer risks range from 2×10^{-7} (construction worker) to 3×10^{-5} (angler) for all exposure scenarios. For non-cancer hazards, the calculated hazard indices (HIs) for all receptor groups range from less than 1 to 3 (angler). PCBs are the primary contributor to the estimated risks from fish consumption.

Baseline Ecological Risk Assessment

The baseline ecological risk assessment (BERA) evaluated the potential for adverse effects to ecological receptors from exposure to contaminants within the BCSA. The BERA was conducted in accordance with EPA's 1997 *Ecological Risk Assessment Guidance for Superfund* and its updates. Several ecological receptors were evaluated for both the waterways and marshes:

- Waterway receptors – wading birds (Great blue heron, Black-crowned night heron); shorebird (Spotted sandpiper); mammal (Raccoon); fish community (Mummichog, White perch); and benthic community

What Is Ecological Risk and How Is It Calculated?

A Superfund baseline ecological risk assessment is an analysis of the potential adverse health effects to biota caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current and future land and resource uses. The process used for assessing site-related ecological risks includes:

Problem Formulation: In this step, the contaminants of potential concern (COPCs) at the site are identified. Assessment endpoints are defined to determine what ecological entities are important to protect. Then, the specific attributes of the entities that are potentially at risk and important to protect are determined. This provides a basis for measurement in the risk assessment. Once assessment endpoints are chosen, a conceptual model is developed to provide a visual representation of hypothesized relationships between ecological entities (receptors) and the stressors to which they may be exposed.

Exposure Assessment: In this step, a quantitative evaluation is made of what plants and animals are exposed to and to what degree they are exposed. This estimation of exposure point concentrations includes various parameters to determine the levels of exposure to a chemical contaminant by a selected plant or animal (receptor), such as area use (how much of the site an animal typically uses during normal activities); food ingestion rate (how much food is consumed by an animal over a period of time); bioaccumulation rates (the process by which chemicals are taken up by a plant or animal either directly from exposure to contaminated soil, sediment or water, or by eating contaminated food); bioavailability (how easily a plant or animal can take up a contaminant from the environment); and life stage (*e.g.*, juvenile, adult).

Ecological Effects Assessment: In this step, literature reviews, field studies or toxicity tests are conducted to describe the relationship between chemical contaminant concentrations and their effects on ecological receptors, on a media-, receptor- and chemical-specific basis. In order to provide upper and lower bound estimates of risk, toxicological benchmarks are identified to describe the level of contamination below which adverse effects are unlikely to occur and the level of contamination at which adverse effects are more likely to occur.

Risk Characterization: In this step, the results of the previous steps are used to estimate the risk posed to ecological receptors. Individual risk estimates for a given receptor for each chemical are calculated as a hazard quotient (HQ), which is the ratio of contaminant concentration to a given toxicological benchmark. In general, an HQ above 1 indicates the potential for unacceptable risk. The risk is described, including the overall degree of confidence in the risk estimates, summarizing uncertainties, citing evidence supporting the risk estimates and interpreting the adversity of ecological effects.

- Marsh receptors – songbird (Red-winged blackbird, Marsh wren); Mammal (Muskrat); and marsh community (*Phragmites*)

For the waterway receptors, unacceptable risks were found for shorebirds *(e.g.*, sandpiper) that are exposed to COCs by ingesting sediment in mudflats. These risks are highest in UBC and MBC. The COCs that are the largest contributors to risk include chromium and mercury. Unacceptable risks were also found for wading birds and fish in certain reaches of BCSA but were calculated to be lower than the risks associated with shorebirds. Potential risks to mammals and the benthic community are within the acceptable risk range.

Ecological risks are lower in the marshes than the waterways. For the marshes, the highest risk is to muskrats, which just exceeds the acceptable risk range. Potential risks to songbirds and the marsh community are not unacceptable, although some uncertainty remains.

Elevated near-surface COC concentrations in the UPIC marsh sediment (which are elevated compared to other BCSA marshes), and relatively low sediment accumulation rates in UPIC marsh, contribute to the potential for exposure of ecological receptors that may come into direct contact with the marsh sediment under current conditions.

Basis for Action

It is EPA's current judgment that the preferred alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) provide a general description of what the interim remedial action is intended to accomplish. Development of the RAOs considered the understanding of the contaminants in the BCSA and is based upon an evaluation of risk to human health and the environment, control of the source of those risks, and maintaining the stability of the extensive marsh habitat. The following RAOs have been developed for the Phase 1 Remedy:

- Control the sources of COCs by replacing the current biologically active zone[2] in the UBC, MBC, and UPIC waterway soft sediment[3], thereby reducing exposure of human and ecological receptors to COCs in the waterways.

- Control the sources of COCs by replacing the current biologically active zone in the UBC, MBC, and UPIC waterway soft sediment, thereby reducing resuspension of COCs into the water column and transport into adjacent marshes and downstream study segments (BCC and LBC).

- Control the sources of COCs to UPIC marsh water column by replacing the current biologically active zone in the UPIC marsh sediments, thereby reducing exposure and COC transport to the UBC water column.

EPA defines the source areas for the Phase 1 interim remedial action geographically as the soft sediment in waterways of UBC, MBC (above the breakpoint[4]) and UPIC, shown on Figure 5, as well as the surface sediment in the marshes in UPIC. For the waterways, the near-term performance measure is to ensure that the interim remedial action controls the sources of COCs in more than 95% of the targeted surface area that is addressed by the remedial action. Greater percentages of success are anticipated in the main stem waterways, compared to the narrow, shallow tributaries where implementation will be more challenging. In addition, post-remediation monitoring will include, among other things, sampling of surface sediment, surface water and biota in the remediation footprint, as well as in LBC and BCC, in order to evaluate remedy effectiveness and degree of recontamination. Specifics of the monitoring

[2] A biologically active zone thickness of 10 cm was established for MBC, BCC, and LBC waterway soft sediment, and of 6 cm for UBC waterway soft sediment, based on site-specific data collected during the RI regarding the depth to which biological activity (*e.g.*, burrowing of worms and other organisms) occurs.

[3] Soft sediment is the recently deposited (last 100 years) alluvial sediment in waterways that has not undergone longer term compaction and related geochemical changes.

[4] The breakpoint is a location in Middle Berry's Creek where changes in the physical system result in a step-wise change of contaminant concentrations upstream and downstream of this point (See, Figure 6)

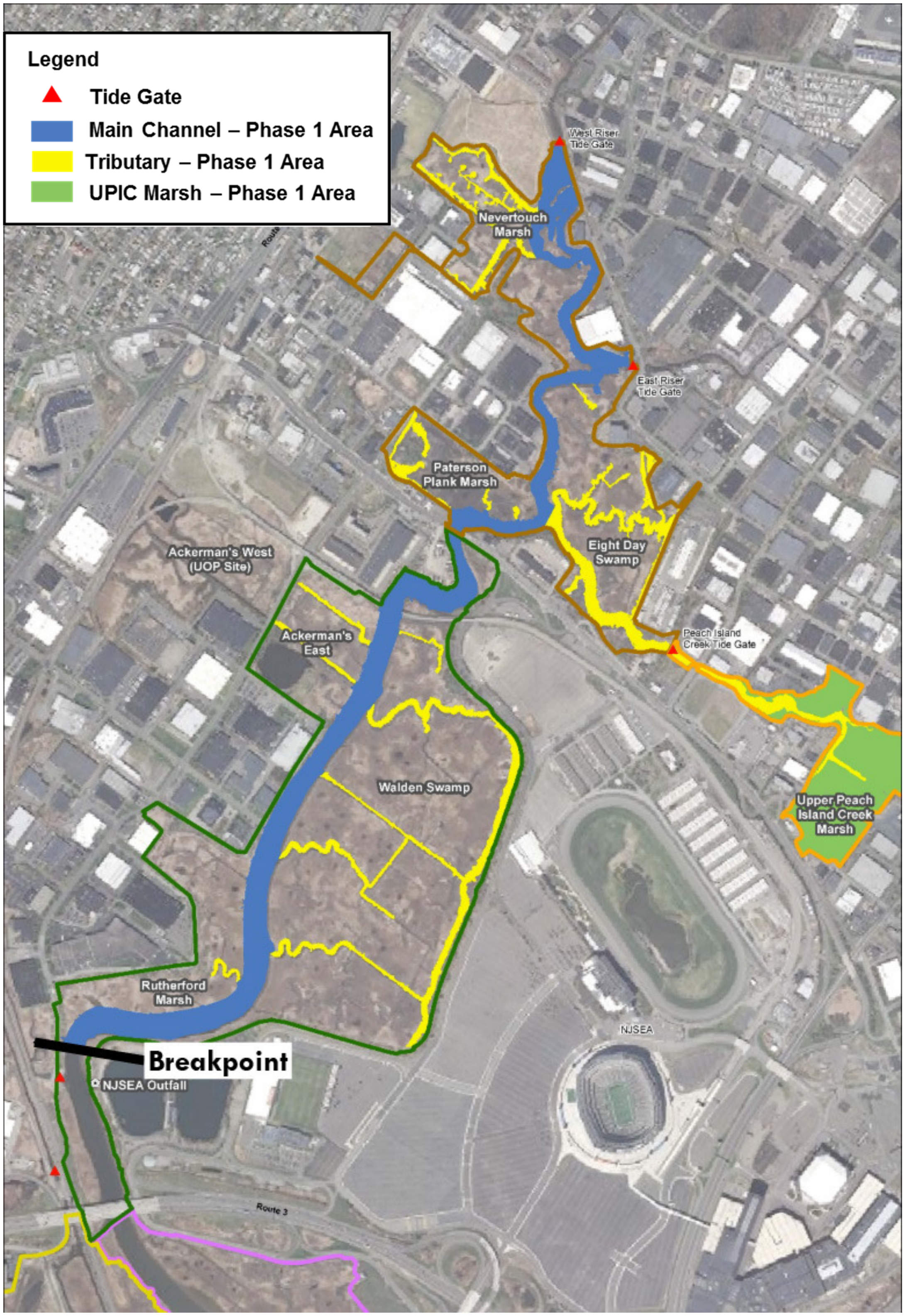

Figure 5. Extent of BCSA Phase 1 Interim Remedial Action

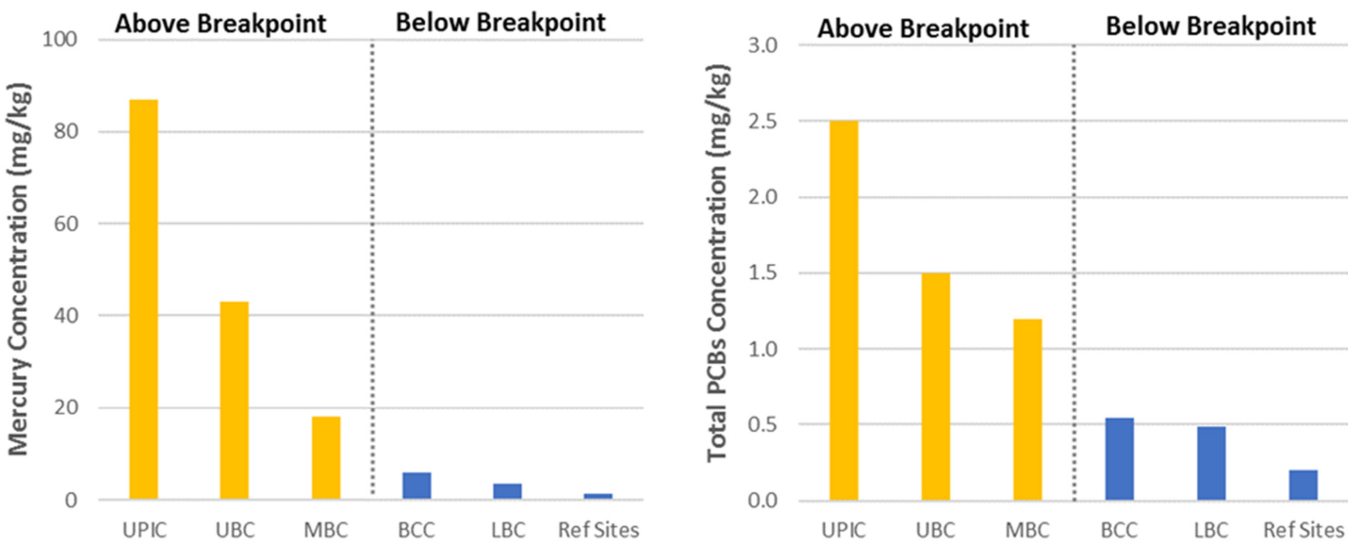

Figure 6. Median concentrations above and below the breakpoint for Mercury and PCB

programs will be determined during the Remedial Design.

In UPIC marsh, the near-term performance measure is to ensure that the interim remedial action controls the sources of COCs in more than 95% of the targeted surface area that is addressed by the remedial action Again, most of the area should easily exceed this performance measure, with more challenging implementation around the radio towers.

The percentage of targeted areas addressed will be calculated by use of a digital mapping comparison of targeted areas to the areas remediated.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA Requirements

Section 121(b)(1) of CERCLA, 42 U.S.C. § 9621(b)(1), mandates that remedial actions must be protective of human health and the environment, be cost-effective, and use permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. CERCLA § 121(d), 42 U.S.C. § 9621(d), further specifies that a remedial action must require a level or standard of control of the hazardous substances, pollutants, and contaminants that at least attains applicable or relevant and appropriate requirements (ARARs) under federal and state laws, unless a waiver can be justified pursuant to CERCLA § 121(d)(4), 42 U.S.C. § 9621(d)(4).

This Proposed Plan presents EPA's preferred interim source control remedy for the BCSA and evaluates whether it satisfies the various mandates of CERCLA. Interim actions must protect human health and the environment from the threats they are addressing, be cost effective, and consistent with the final remedy. The remedial alternatives evaluated in the BCSA FS Report, except for the statutorily-required no action alternatives and Alternative W2 (capping only), are all protective of human health and the environment, comply with ARARs, and are cost-effective, thus satisfying the requirements of CERCLA. As discussed below, most alternatives include the use of treatment technologies as part of dredged materials management.

The remedial alternatives evaluated for the Phase 1 interim remedial action (except for the no action alternatives) focus on source control. Five remedial alternatives were developed for the Phase 1 interim remedial action for the UBC and MBC waterways, and five remedial alternatives were developed for UPIC marsh. Brief descriptions of the remedial alternatives evaluated for the Phase 1 interim remedial action are given below. More detailed information regarding the alternatives is provided in the BCSA FS Report.

As part of the study to evaluate potential treatment technologies and remedies for the BCSA, it was concluded that the sediments could not be treated in place. Similarly, an evaluation of alternatives for excavated/dredged sediment could not identify a cost-effective treatment technology to reduce toxicity, mobility and volume when compared to off-site disposal. However, alternatives involving sediment removal would likely require the addition of a stabilizing agent to transport the material for off-site disposal. The stabilizing material would help solidify the material so that it would comply with transportation requirements. Stabilizing agents (*e.g.*, Portland cement) also typically reduce the mobility of the contaminants and, therefore, serve as a form of treatment.

The areal extent of active remediation in the UBC and MBC waterways with all four alternatives is the same and is shown in Figure 5. The Phase 1 area for the waterways encompasses 87.2 acres, which represents the entire UBC and MBC main waterway down to the downstream limit of Phase 1 near the breakpoint (near the East Rutherford tide gate and NJSEA outfall).

Most of the waterway tributaries to UBC and MBC area are included in the Phase 1 area. Tributaries selected for remediation are the primary tributaries (*i.e.*, directly connected to the main channel) that were shown in the BCSA RI Report to be the primary water conveyances between the main channel and the marshes (typically 20 feet or larger in width, extend more than 500 feet from the main channel, and have elevated COC concentrations relative to the marshes). Other common elements include post-remediation monitoring and maintenance and institutional controls (ICs) Five-year reviews would be conducted since contamination would remain above levels that allow for unlimited use and unrestricted exposure.

Dredging: For each alternative that includes dredging, remediation would start with waterway debris removal followed by dredging of soft sediment to the specified removal depths as described below. The area to be dredged would extend across the width of the waterway from marsh bank to marsh bank and would include the soft sediments in both the channel and the mudflats (to the Mean Tide Level (MTL)). The depth of dredging would be to the depth specified in the alternative, plus an additional 6-inch over-dredge to ensure that the specified depth is reached. While the sequence for dredging the 87.2 acres would be developed during the remedial design, the work generally is anticipated to move from upstream to downstream to better manage the recontamination potential for dredged and backfilled areas. It is also anticipated that tributaries along each reach of the waterways would be dredged prior to the adjacent main channel, again to manage recontamination potential. For planning and cost estimating purposes, the FS anticipated that hydraulic dredging would be conducted in most areas using 8- and 12-inch suction cutterhead dredges. In limited areas, amphibious excavators would likely be used. Technical challenges associated with dredging in the Phase 1 area include shallow water depth, narrow tributaries, and the substantial diurnal tide cycle (typically 5.7 to 6.0 feet between high and low tide). Throughout the dredging program, sediment resuspension and residuals will be limited through the use of appropriate management practices.

Dredged sediment would be pumped through pipes to a central sediment management area(s), dewatered using geotextile tubes or mechanical dewatering equipment, mixed with an amendment (*e.g.*, Portland cement) as needed for the sediment to meet transportation and disposal requirements, and then transported for disposal at an off-site commercial disposal facility. Based on the concentrations and generally low solubility of the contamination at the BCSA, it is anticipated that most of the dredged material will be disposed of as non-hazardous waste at a RCRA Subtitle D facility. The FS was developed assuming truck transport of the sediment to the facility. During the remedial design, train and barge transport will also be evaluated.

Backfill/Capping: Backfilling/capping are common components of all the active waterway remedial alternatives. Backfilling/capping after dredging would be applied in multiple lifts after dredging throughout the 87.2-acre Phase 1 remediation footprint. Backfill/cap thickness for Alternatives W3, W4, and W5 would equal soft sediment removal thicknesses. Backfill/cap thicknesses were selected based both on considerations of performance effectiveness and maintaining the hydrodynamic and sediment-transport characteristics of the waterway. In areas where all soft sediment is removed, there is no capping function for the backfill because all the contamination has been removed. Where contaminated soft sediment remains after dredging, the backfill will serve the additional function of capping and physically isolating the remaining material. The sequencing of backfill/cap placement would be determined during the remedial design. The reason for placing multiple lifts (layers) is both to limit the effects of soft sediment resuspension and residuals during the dredging process and to maintain the stability of any remaining soft sediment in the waterways. Cap material for Alternative W2, which does not include any dredging, would also be placed in lifts for the same reasons just described for the other waterway alternatives. Backfill and cap material is anticipated to be a silty sand or sand that is stable and would not erode under the hydrodynamic forces that can exist during storm events in the BCSA. Placement methods for the backfill and cap material would be determined during the remedial design.

Post-Remediation Monitoring and Maintenance, and Institutional Controls (ICs): All active remedial alternatives for the waterways would be monitored and maintained, and all will include ICs. Monitoring of the remedial alternatives would start during their construction. Requirements for monitoring during construction will be developed during the remedial design. Remedy performance monitoring would be conducted post-remediation and include monitoring of Marsh Demonstration Project areas (to be detailed in the Remedial Design [RD] Work Plan) to further evaluate thin-layer capping technologies in the BCSA tidal marshes. The scope of such monitoring would be described in a Performance Measures Monitoring Plan (PMMP) that would also be developed as part of the remedial design. In addition to post-remediation monitoring, maintenance would be conducted as necessary to ensure the effectiveness of the remedy. Maintenance could include, for example, replenishment of backfill in an area should an unanticipated significant disturbance occur. ICs for the waterways would include continuing New Jersey fish consumption advisories as well as setting local waterway use restrictions.

In the description of alternatives that follow, all removal and backfill/cap material volumes contain, as applicable, allowances for over-dredging and over-excavation, material loss, and volume uncertainty contingency. All reported cost estimates include direct and indirect capital costs, direct and indirect operations and maintenance (O&M) costs (including performance monitoring), and contingency. The costs are presented as present value, discounted by the 7% discount factor specified in EPA guidance.

Description of Waterway Alternatives

Alternative W1: No Action: The Superfund program requires that the No Action alternative be considered as a baseline for comparison with the other alternatives. The No Action alternative would consist of taking no specific remedial action and allowing the waterways to continue to recover naturally. This alternative would not change or add to the current fish consumption advisories already in place in the BCSA, nor would it include monitoring of the progress of natural recovery.

- Volume of sediment removal: 0 cubic yards
- Volume of backfill (backfill/cap) material: 0 cubic yards
- Present Value: $0
- Estimated construction time: 0 years

Alternative W2: Cap Addition: Alternative W2 would involve placement of a 2-foot thick cap/cover layer from marsh bank to marsh bank throughout the Phase 1 waterway footprint. Figure 7 presents an illustrative cross section of such a 2-foot thick cap/cover layer. With this alternative, the cap/cover material would be placed directly onto the existing sediment bed without removing any sediment. The intent with Alternative W2 would be to achieve the Phase 1 waterway source control RAOs at the end of construction by isolating COCs in the sediment from the water column. A new BAZ layer would develop at the surface of the cap/cover layer over time.

- Volume of sediment removal: 0 cubic yards
- Volume of backfill (cap) material: 335,900 cubic yards
- Estimated present value: $101 million
- Estimated construction time: 3.3 years

Alternative W3: 1-foot Sediment Removal + Backfill/Cap: Alternative W3 would provide source control and achieve the Phase 1 RAOs at the end of construction by removing soft sediment to a depth of 1 foot (plus over-dredge), or to firmer consolidated sediment[5], whichever is encountered first. This would be followed by placing a thickness of

[5] Testing conducted within the BCSA has demonstrated that COCs do not penetrate into this firmer consolidated sediment, which usually consists of significant amounts of clay.

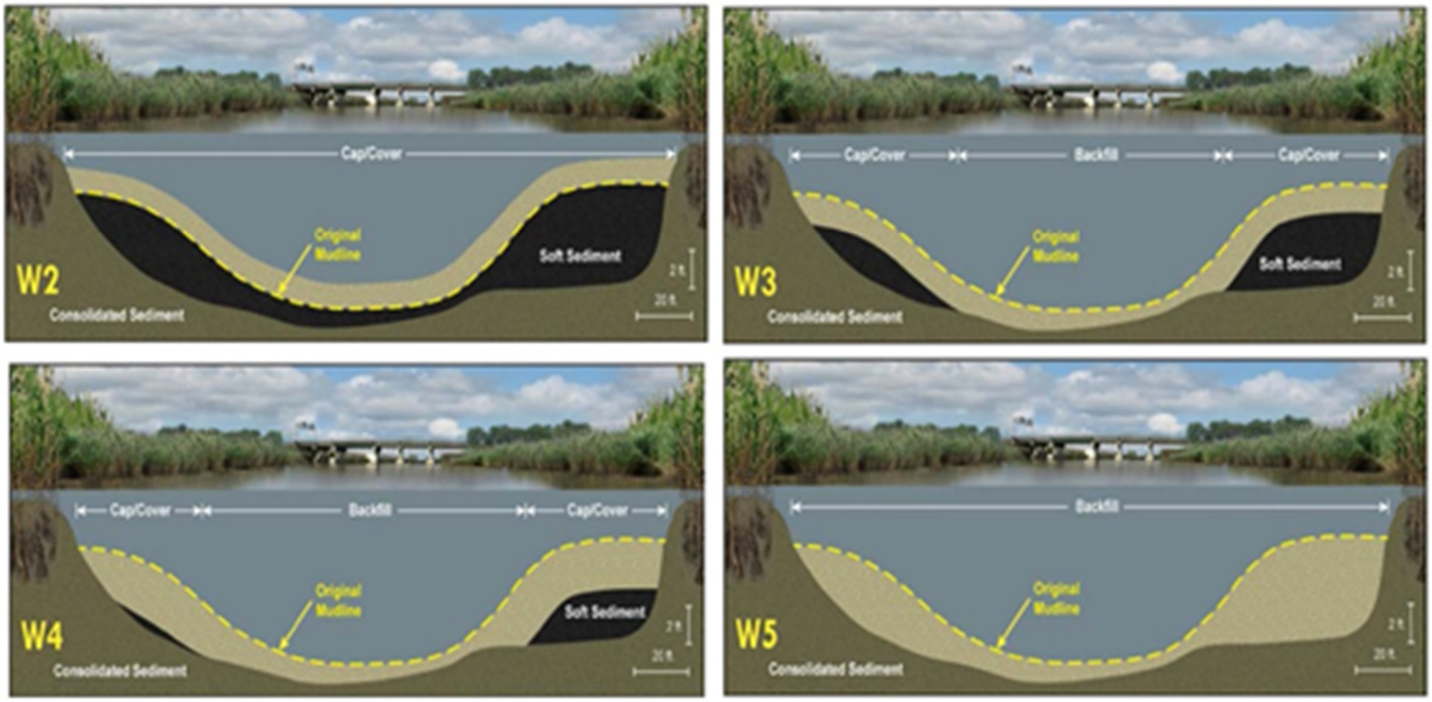

Figure 7. Illustrations of BCSA Alternatives W2 through W5

backfill/cap material into the dredged waterway equal to the removal thickness. This removal depth includes the current BAZ plus a substantial additional thickness of soft sediment. An illustrative cross section of this alternative is shown in Figure 7. After backfilling/capping is complete, a new BAZ would become established over time on top of the backfill/cap material.

- Volume of sediment removal: 245,700 cubic yards
- Volume of backfill/cap material: 282,500 cubic yards
- Approximate percentage of Phase 1 waterway footprint undergoing complete soft sediment removal: 35%
- Estimated present value: $206 million
- Estimated construction time: 2.8 years

Alternative W4: 2-foot Sediment Removal + Backfill/Cap: Alternative W4 would provide source control and achieve the Phase 1 RAOs at the end of construction by removing soft sediment to a depth of 2 feet (plus over-dredge), or to firmer consolidated sediment, whichever is encountered first. This would be followed by placing a thickness of backfill/cap material equal to the removal thickness. This removal depth includes the current BAZ plus an even more substantial additional thickness of soft sediment than for Alternative W3. An illustrative cross section of this alternative is shown in Figure 7. After backfilling/capping is complete, a new BAZ would become established over time on top of the backfill/cap material.

- Volume of sediment removal: 363,000 cubic yards
- Volume of backfill (cap/cover) material: 417,500 cubic yards
- Approximate percentage of Phase 1 waterway footprint undergoing complete soft sediment removal: 64%
- Estimated present value: $261 million
- Estimated construction time: 3.5 years

Alternative W5: Removal of All Soft Sediment + Backfill: This alternative would provide source control and achieve the Phase 1 RAOs at the end of construction through the removal of all soft sediment except for sediment residuals remaining after the completion of dredging operations. This would include the current BAZ plus the large volume of additional soft sediment. After dredging, a backfill thickness up to the sediment removal thickness

ALTERNATIVE #	WATERWAY ALTERNATIVE	VOLUME REMOVED (cubic yards)	VOLUME BACKFILL / CAP (cubic yards)	ESTIMATED COST	ESTIMATED CONSTRUCTION TIME (years)
W1	No Action	0	0	0	0.0
W2	Cap Only	0	335,900	$101 M	3.3
W3	One-foot Sediment Removal + Backfill/Cap	245,700	282,500	$206 M	2.8
W4	Two-foot Sediment Removal + Backfill/Cap	363,000	417,500	$261 M	3.5
W5	Removal of All Soft Sediment + Backfill	646,000	743,400	$393 M	4.9

Table 2. Waterways Alternatives Summary

would be placed. An illustrative cross section of this alternative is shown in Figure 7. After backfilling is complete, a new BAZ would become established over time on top of the backfill.

- Volume of sediment removal: 646,000 cubic yards
- Volume of backfill material: 743,400 cubic yards
- Approximate percentage of Phase 1 waterway footprint undergoing complete soft sediment removal: 100%
- Estimated cost: $393 million
- Estimated construction time: 4.9 years

Alternatives for UPIC Marsh

<u>**Common Elements**</u>

General Description: Except for the no action alternative, all the UPIC marsh remedial alternatives include the common source control components of sediment excavation and/or containment. Alternatives UPIC3, UPIC3-A and UPIC4 (described in detail below) all involve sediment excavation and backfilling. Alternatives UPIC3 and UPIC4 involve sediment excavation and backfilling throughout the 28.2-acre marsh. Alternative UPIC3-A involves excavation and backfilling in approximately 86.5% of the marsh with thin layer cover being the selected remedial technology in the remainder of the marsh. With Alternative UPIC-3-A, thin layer cover would be applied in the southern portion of the marsh in the vicinity of the eight tall radio towers in that area. This is also an area that contains lower COC concentrations compared to other areas of UPIC marsh. Alternative UPIC2 would involve the application of thin-layer cover throughout the entire UPIC marsh. These remedial alternatives also include the common components of marsh mitigation, post-remediation monitoring and maintenance, and ICs.

Marsh Excavation: Alternatives UPIC3, UPIC3-A, and UPIC4 would all involve excavation of marsh sediments in all or a majority of the marsh to depths well below the depth at which there is a potential for human and ecological exposures, which is the marsh surface detritus layer and the top 1 to 2 inches of sediment. The excavation depth would also be significantly greater than the depth interval at which the highest COC concentrations occur. The depth of excavation would be to the depth specified in the alternative, plus an additional 6-inch over-excavation to ensure that the specified depth is reached. The horizontal extent of the excavation alternatives (UPIC3, UPIC3-A, and UPIC4) will require adjustment around the radio towers, where infrastructure limitations will influence the remedial action and will be made as part of the remedial design process.

Because the UPIC marsh is non-tidal (as it is located above a tide gate), it is anticipated that sediment excavation would be completed using conventional or light ground pressure equipment. Dewatering of the marsh during construction would likely be required in areas with standing water and following significant precipitation events. Excavated sediment would be dewatered and treated with an amendment (*e.g.*, Portland cement) so that it satisfies transportation and disposal requirements. The FS was developed assuming truck transport of the treated sediment. During the remedial design, train and barge transport will also be evaluated.

Backfilling: Backfilling for Alternatives UPIC3, UPIC3-A, and UPIC4 would be conducted throughout the excavation area. Backfill would be placed in phases as excavation activities in discrete areas of the marsh are progressively completed. Backfill thicknesses would be sufficient to maintain the current marsh elevation and hydrology. Backfill material would include a sand or silty-sand organic mix designed to promote re-establishment of the marsh at the completion of the remedial action and protect restored areas from upland storm water flows that enter the UPIC area at some locations.

Thin-Layer Cover: Thin-layer cover would be installed with Alternatives UPIC2 and UPIC3-A. This technology would involve placement of sand or finer-grained soil material in a thin layer over the surface of the marsh. The objective would be to maintain long term stability of the underlying contaminated sediment and eliminate the ecological exposure pathways that pose an unacceptable risk. A cover layer thickness of 6 inches has been chosen to provide a substantial layer of fill to establish a clean post-remediation surface and to isolate underlying marsh sediment. Pilot studies conducted at multiple locations in the BCSA as part of the RI/FS demonstrated the implementability and stability of thin-layer test plots in BCSA marshes. The plots have remained stable since their construction in 2012 and 2013 through several large storm events, including Hurricane Sandy in 2012.

Marsh Mitigation: The UPIC marsh habitat would be disturbed in areas of thin-layer placement with Alternatives UPIC2 and UPIC3-A and would need to be re-established. The habitat would be destroyed in areas of excavation and backfilling with Alternatives UPIC3, UPIC3-A, and UPIC4 and would likewise need to be mitigated. For all the alternatives, a marsh mitigation plan would be developed as part of the remedial design. For the FS cost estimates, it was assumed that for both marsh excavation and backfilling, or thin-layer cover, the entire marsh would be re-established in-kind consistent with existing vegetation (*Phragmites*).

Post-Remediation Monitoring and Maintenance, and ICs: As with the waterway remedial alternatives, all active remedial alternatives for the waterways would be monitored and maintained, and 3 of the 4 alternatives would include ICs. Monitoring of the remedial alternatives would start during construction. Remedy performance monitoring would be conducted post-remediation with all the active remedial alternatives. The scope of such monitoring would be described in the PMMP. In addition to post-remediation monitoring,

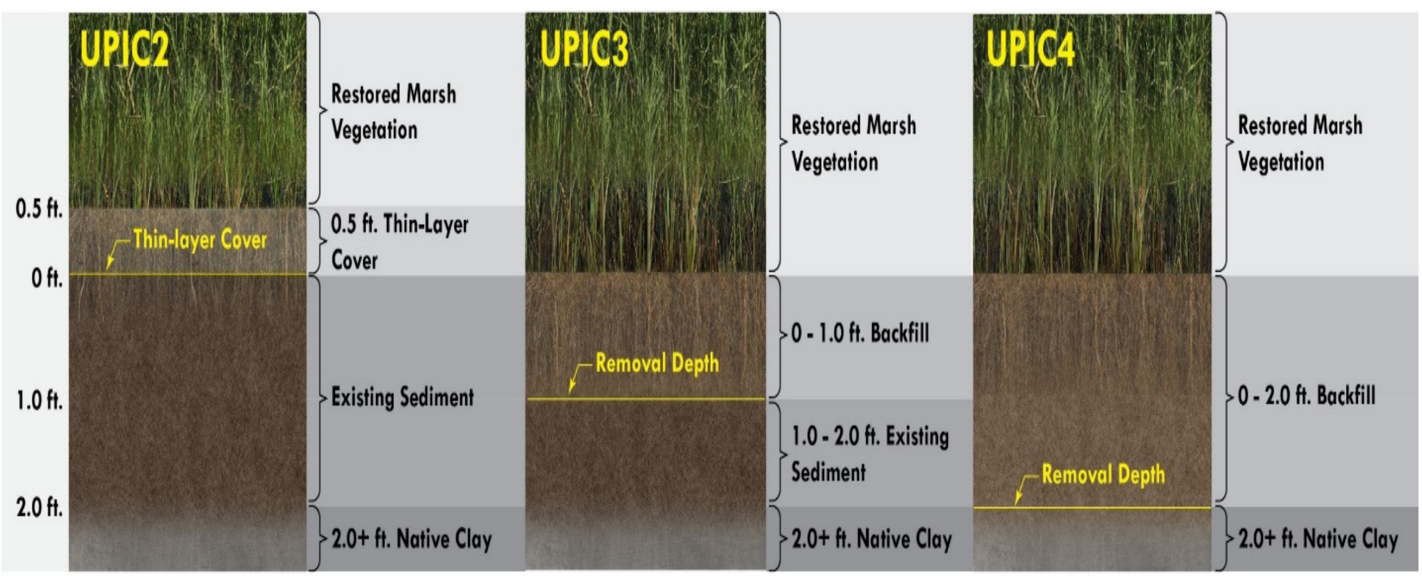

Figure 8. Illustrations of UPIC Marsh Alternatives UPIC2, UPIC3, and UPIC4

maintenance would be conducted as necessary to assure the effectiveness of the remedy.

Maintenance could include, for example, backfill replenishment in an area should unanticipated significant disturbance occur and/or replanting of marsh vegetation. ICs for all the active marsh remedial alternatives may include property use and access restrictions. Because Alternative UPIC4 would involve the removal of essentially all sediment with elevated COC concentrations, property use and access restrictions are not considered necessary.

Description of UPIC Marsh Alternatives

Alternative W1: No Action: The No Action alternative would consist of taking no specific remedial action and allowing the UPIC marsh to continue to recover naturally. This alternative would not include ICs nor would it include monitoring of the progress of natural recovery.

- Volume of sediment excavation: 0 cubic yards
- Volume of backfill or thin-layer cover: 0 cubic yards
- Cost: $0
- Estimated construction time: 0 years

Alternative UPIC2: Thin-Layer Cover: This alternative would involve placement of a thin layer of approximately six inches of sand or fine-grained material over the surface of the marsh. The intent of Alternative UPIC2 would be to achieve an immediate reduction in COC concentrations at the surface of the marsh where ecological exposure potential is greatest. In doing so, the UPIC marsh source control RAO would be achieved at the end of construction. Figure 8 presents an illustrative cross section of the alternative. This alternative would result in an increase, albeit small, in UPIC marsh surface elevations. Note though, surface elevations in the marsh are, on average, 2 feet lower than in the BCSA tidal marshes. The net fill to the marsh is small enough that this alternative could meet the substantive standards of the New Jersey Flood Hazard Control Act and Federal Floodplain Management requirements that address net filling in floodplains.

- Volume of sediment excavation: 0 cubic yards
- Volume of backfill or thin-layer cover: 26,200 cubic yards
- Estimated present value: $25 million
- Estimated construction time: 1.0 years

Alternative UPIC3: 1-foot Sediment Removal + Backfill: This alternative would involve excavation of contaminated sediment in UPIC marsh to the bottom of the dense, fibrous portion of the *Phragmites* root mat. This bottom occurs at a depth below ground surface of about 1 foot. The depth of excavation would be increased at the marsh banks next to the UPIC waterways, to effectuate a smooth transition between the marsh and waterway remedial components and to assure ongoing stability of the marsh banks. The extent of removal in the area of the radio towers would be determined during design. Figure 8 presents an illustrative cross section of the alternative. Excavated marsh areas would be backfilled as described above and the marsh habitat restored. This alternative would achieve the UPIC marsh source control RAO at the end of construction.

- Volume of sediment excavation: 78,500 cubic yards
- Volume of backfill or thin-layer cover: 90,300 cubic yards
- Estimated present value: $62 million
- Estimated construction time: 1.4 years

Alternative UPIC3-A: Hybrid – Removal + Backfill and Thin-Layer Cover: Alternative UPIC3-A essentially involves implementation of Alternative UPIC3 throughout the majority of the marsh and Alternative UPIC2 in a small portion of the marsh. The portion of UPIC marsh that would undergo a 1-foot removal followed by backfilling under Alternative UPIC3-A is shown in Figure 8. The estimated area of sediment removal and backfilling is approximately 24.4 acres (86.5 percent of the total UPIC marsh area). Along the banks of the UPIC waterways, the removal would be extended to a depth of 2 feet in a zone approximately 10 feet wide, to effectuate a smooth transition between the marsh and waterway remedial components and to assure ongoing stability of the marsh banks. A 6-inch thin layer cover would be placed in the vicinity of the radio

Alternative #	UPIC MARSH ALTERNATIVE	VOLUME REMOVED (cubic yards)	VOLUME BACKFILL / CAP (cubic yards)	VOLUME THIN-LAYER COVER (cubic yards)	ESTIMATED COST	ESTIMATED CONSTRUCTION TIME (years)
UPIC1	No Action	0	0	0	$0	0.0
UPIC2	Thin-Layer Cover	0	0	26,200	$25 M	1.0
UPIC3	One-foot Sediment Removal + Backfill	78,500	90,300	N/A	$62 M	1.4
UPIC3-A	Hybrid - Removal + Backfill + Thin-Layer Cover	69,500	80,000	3,600	$58 M	1.1
UPIC4	Two-foot Sediment Removal + Backfill	130,800	150,400	N/A	$86 M	1.9

Table 3. Upper Peach Island Creek Marsh Alternatives Summary

towers (see, Figure 9), due to logistical, health and safety and sediment stability considerations associated with marsh excavation near the towers. The estimated area that would receive this thin-layer cover is 3.8 acres (13.5 percent of the total UPIC marsh area of 28.2 acres). This alternative would achieve the UPIC marsh source control RAO at the end of construction.

- Volume of sediment excavation: 69,500 cubic yards
- Volume of backfill: 80,000 cubic yards
- Volume of thin-layer cover: 3,600 cubic yards
- Estimated present value: $58 million
- Estimated construction time: 1.1 years

Alternative UPIC4: 2-foot Sediment Removal + Backfill: This alternative would involve sediment excavation in the UPIC marsh down to the bottom of the soft sediment. Figure 8 presents an illustrative cross section for the alternative. A 2-foot excavation depth would be much deeper than the depth of the highest concentrations of COCs in UPIC marsh. At a depth of 2 feet, COC concentrations are very low to non-detect. The intent of this alternative would be to achieve the UPIC marsh RAO at the end of construction by removing essentially all the soft sediment and replacing it with clean backfill. The extent of removal in the area of the radio towers would be determined during design. The functions of the backfill would be to cover any sediment residuals, re-establish pre-remedy marsh elevations, and support marsh mitigation.

- Volume of sediment excavation: 130,800 cubic yards
- Volume of backfill: 150,400 cubic yards
- Estimated present value: $86 million
- Estimated construction time: 1.9 years

EVALUATION OF REMEDIAL ALTERNATIVES

NCP Threshold, Balancing, and Modifying Criteria

In this section of the Proposed Plan, the Phase 1 remedial alternatives are evaluated and compared

to each other using the nine criteria set forth in the NCP at 40 CFR §300.430(e)(9)(iii). These criteria fall into three categories--threshold criteria, balancing criteria, and modifying criteria.

Figure 9. Layout of UPIC Marsh Alternative UPIC3-A

Threshold Criteria:

1. *Overall Protection of Human Health and the Environment* evaluates whether an alternative eliminates, or effectively controls threats to public health and the environment.
2. *Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)* evaluates whether the alternative meets federal and state environmental statutes, regulations, and other promulgated requirements that pertain to the site, or whether a waiver is justified.

Balancing Criteria:

3. *Long-term Effectiveness and Permanence* considers the ability of an alternative to maintain protection of human health and the environment over time.
4. *Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment* evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, or the amount of contamination present.
5. *Short-term Effectiveness* considers the length of time needed to implement an

alternative and the risks the alternative poses to workers, the community, and the environment during implementation.

6. *Implementability* considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
7. *Cost* includes estimated direct and indirect capital and O&M costs, as well as present value cost. Present value cost is the total cost of an alternative over time in terms of today's dollar value, calculated using a discount rate of 7%, consistent with EPA guidance. Cost estimates are expected to be accurate within a range of +50 to -30 percent of the actual cost to implement the alternative. A remedy is cost effective if its costs are proportional to its overall effectiveness (40 CFR Section 300.430(f)(1)(ii)(D).

Modifying Criteria:

8. *State/Support Agency Acceptance* considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.
9. *Community Acceptance* considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

All NCP evaluation criteria, except the two modifying criteria (*i.e.*, state acceptance and community acceptance) were evaluated as part of the FS. State acceptance was discussed between EPA and NJDEP during the preparation of this Proposed Plan. Community acceptance will be evaluated following receipt and consideration of comments on this Proposed Plan. A summary of the comparative analysis of alternatives contained in the BCSA FS Report is given below.

In the evaluation of balancing criteria, EPA has assigned each alternative a relative rating between low and high based on the analysis results. A low rating shows that the alternative has a low level of achievement of some or all the factors considered for the criterion compared to other alternatives, while a high rating indicates a high relative level of achievement. Intermediate levels of achievement are rated as low to moderate, moderate, and moderate to high.

Analysis of Waterway Alternatives

Protection of Human Health and the Environment: Alternative W1 (No Action) would not be protective of human health and the environment because it would not reduce the potential exposure of human and ecological receptors to COCs in BAZ sediment in the UBC and MBC waterways within a reasonable timeframe. In addition, Alternative W1 would not reduce particulate-bound COC resuspension into the water column. As it would not meet this threshold criterion, Alternative W1 was not evaluated against the NCP balancing criteria. Alternatives W2 to W5 would all satisfy this NCP threshold criterion. Alternative W2 would be protective of human health and the environment through installation of a 2-foot thick cap layer over the existing waterway sediment sources. Alternatives W3 to W5 would achieve this threshold criterion by removing the source of COCs in the Phase 1 waterways and by placing a backfill/cap layer designed to prevent COCs at depth from being re-exposed and, therefore, becoming potential sources for human or ecological exposures.

Compliance with ARARs: Alternative W1 would not comply with certain ARARs (such as surface water quality criteria) since the criteria are exceeded presently, and no action would be undertaken. Alternatives W3 to W5 could be implemented to meet the Phase 1 ARARs described in the FS Report and thus satisfy this NCP threshold criterion for the sediments. Because it adds a 2-foot layer of net fill to the waterways, Alternative W2 would likely not meet the substantive standards of the New Jersey Flood Hazard Control Act Rules and Federal Floodplain Management requirements. As described in the FS Report, for Alternative W2 to be selected by EPA, ARAR waivers would likely be needed (assuming a basis could be established), along with design measures to address an increased potential for upland flooding and other impacts associated with the net waterway fill. To summarize: ARARs do not apply to W1, since no action would be taken, W2 could be selected only if a basis could be established for ARAR waivers, and alternatives W3, W4 and W5 would comply with ARARs.

Long-Term Effectiveness and Permanence*:* Alternative W2 is given a low to moderate rating based on the impacts of the placement of 2 feet of cap in the UBC/MBC waterways. This net fill would likely lead to adverse impacts on waterway hydrodynamics, sediment erosion and scour potential, upland flooding potential, and marsh stability and habitat quality. Unlike Alternative W2, Alternatives W3 to W5 would not adversely change the waterway bathymetry or hydrodynamics, which have shown a high level of resiliency, observed through tropical storms and two hurricanes during the remedial investigation.

Alternatives W3 to W5 would remove sediment that serves as the current source for potential human and ecological exposures and COC transport. For these alternatives, remedy effectiveness would be enhanced by placing the backfill/cap material in several lifts to minimize residuals. Alternative W3 would include a 1-foot sediment removal depth and backfill/cap thickness, adequate to isolate the new, post-remediation BAZ from remaining soft sediment below the backfill/cap, effectively mitigating exposure to and transport of the COCs. Alternative W3 is given a moderate rating. While the backfill/cap layer for W3 would be robust, the potential need for future backfill/cap maintenance with this alternative would be higher than with Alternatives W4 and W5. The sediment removal and backfill/cap thicknesses for Alternatives W4 and W5 would both be more than adequate and would have high long-term effectiveness. Alternative W4 is given the same high rating as Alternative W5 because it achieves the Phase 1 RAOs in a robust manner and there is no further reduction in human or ecological exposure risk with Alternative W5 compared to Alternative W4. To summarize: W2 is rated low to moderate, W3 moderate, and W4 and W5 are rated high for long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume through Treatment: The same moderate relative rating was given to all alternatives involving sediment dredging (*i.e.*, Alternatives W3 to W5), as the same treatment process would be applied to all dredged sediment with these alternatives. This rating was selected recognizing that all dredged sediment would be treated by mixing with a stabilizing agent, as necessary, to meet requirements for waste transportation and disposal. As Alternative W2 would not involve a dredging component, and hence would not incorporate any sediment treatment component, it was given a low rating with respect to this balancing criterion.

Short-Term Effectiveness: Alternative W2 would have the fewest potential community impacts and construction worker risks, primarily because it does not have a dredging and sediment management component. Potential community impacts and construction worker risks are generally proportional to the extent and duration of sediment dredging, because dredging involves management of large volumes of sediment and backfill/cap material using heavy equipment and truck transportation of dewatered sediment and backfill/cap material through the community. However, Alternative W2 would have more potential to cause sediment bed instability and lateral movement of mud than the other alternatives, it would cause short-term water quality impacts, and it would take longer to implement than Alternative W3. Based on these considerations, Alternative W2 was given a moderate to high short-term effectiveness rating. Comparing the removal and backfilling alternatives (W3 to W5), Alternative W5 would have the most significant community impacts and worker risks because it involves the largest volumes of sediment dredging, dredged material management, and backfilling; Alternative W3 would have the least community impacts and worker risks; and Alternative W4 would have intermediate impacts and risks. Alternative W3 would have the shortest construction duration and Alternative W5 the longest. All the removal and backfilling/capping alternatives would also have short-term water quality impacts associated with dredging, filling, and water management operations, with Alternative W5 again having the largest impacts and Alternative W3 the smallest. Alternative W5 has the potential to cause water quality impacts due to the risk of marsh bank instability and the need for temporary marsh bank stabilization measures in areas of deep dredging. Environmental impacts would include temporary loss of benthic organisms, as well as habitat for the ecological community in the Phase 1 remediation areas. Post remediation, fine-grained sediment will deposit over the capping or backfill material, which will provide improved conditions for the organisms as the material will be much cleaner than the pre-remediation sediment. Since the remedial action would replace existing habitat (and slightly improve it), no additional compensatory mitigation measures would be necessary for this aspect of the remediation. On a relative basis, the short-term effectiveness of Alternative W3 was rated moderate to high, the short-term effectiveness of Alternative W4 was rated moderate, and the short-term effectiveness of Alternative W5 was rated low to moderate. To summarize: W2 and W3 are rated moderate to high, W4 is lower at moderate and W5

Implementability: Alternative W2 was given a low to moderate implementability rating due to sediment bed settlement and stability challenges, and potential flooding impacts, associated with placement of 2 feet of net fill, the shortest tide windows of all the alternatives for working in the mudflats and shallow tributaries, and the administrative challenges related to the potential need for ARAR waivers. Alternative W5 was given the same low to moderate rating, based on the substantial marsh bank stability challenges associated with complete soft sediment removal. Alternative W5 would also involve more substantial sediment management and water treatment volumes than the other alternatives. Both Alternatives W3 and W4 were given a moderate to high rating due to their limited maximum dredging depths, smaller magnitudes of sediment bed settlement, and lower risks to sediment bed and marsh bank stability.

Cost: A summary of the FS-level cost estimates for Alternatives W2 to W5 is presented in Table 2. The least expensive active remediation option is Alternative W2, Cap Addition. Costs for the removal and backfill/cap alternatives increase with the depth of sediment removal, as the increased amount of dredging and disposal is more resource-intensive. Alternative W3 is about double the cost of Alternative W2. Alternative W4 is about 1.6 times the cost of Alternative W2 and about 30% more costly than Alternative W3. Alternative W5 is almost double the cost of Alternative W3 and 66% more costly than Alternative W4 (due to the much larger sediment removal and backfill volumes involved with Alternative W5).

State Acceptance:

This plan is under review by the New Jersey Department of Environmental Protection.

Community Acceptance:

Community acceptance of the preferred alternative will be evaluated after the public comment period ends.

Analysis of UPIC Marsh Alternatives

Protection of Human Health and the Environment: Alternative UPIC1 would not be protective of human health and the environment because it would not reduce the potential exposure of ecological receptors to COCs from UPIC marsh sediment. As it does not meet this threshold criterion, Alternative UPIC1 was not evaluated against the NCP balancing criteria. Alternatives UPIC2 to UPIC4 would all satisfy this NCP threshold criterion. Alternative UPIC2 would be protective of human health and the environment through installation of a 6-inch thick cover layer over the existing marsh surface. Alternatives UPIC3 and UPIC4 would achieve this criterion by removing the contaminated sediment that is the source of potential ecological exposures and replacing it with a backfill layer that would isolate any remaining contaminated sediment or residuals from the marsh surface. Alternative UPIC3-A would achieve this threshold criterion through the hybrid application of the remedial technologies of Alternatives UPIC2 and UPIC3.

Compliance with ARARs: ARARs applicable to the Phase 1 interim remedial action would not apply to Alternative UPIC1 since no action would be undertaken. Alternatives UPIC3, UPIC3-A, and UPIC4 would comply with the Phase 1 ARARs, thus satisfying this NCP threshold criterion. Alternatives UPIC2 and UPIC3-A would result in placement of a small amount of net fill into the marsh. These alternatives would be designed to comply with the New Jersey Flood Hazard Control Act Rules and Federal Floodplain Management requirements. For example, if necessary, flood storage would be addressed as part of the remedial design to account for the net fill placed in the marsh with either alternative.

Long-Term Effectiveness and Permanence: Alternative UPIC2 is given a moderate relative rating with respect to long-term effectiveness and permanence, while Alternatives UPIC3, UPIC3-A, and UPIC4 are given a high rating. All four active remediation alternatives would reduce or eliminate the potential for exposure of human and ecological receptors to COCs from shallow marsh sediment. Alternatives UPIC3, UPIC3-A, and UPIC4 rate higher than Alternative UPIC2 because the backfill layers would be thicker than the cover layer thickness of Alternative UPIC2. While it is given a lower rating, Alternative UPIC2 would still achieve long-term effectiveness and permanence, but due to UPIC-specific conditions (e.g. hydrology, elevation, and presence of tide gates), it would potentially require more maintenance than Alternatives UPIC3, UPIC3-A, and UPIC4. Alternatives UPIC3, UPIC3-A, and UPIC4 are given the same high rating because they would remove the great majority of the sediment with elevated COC concentrations and they all would provide a backfill thickness more than adequate to provide long-term isolation of the post-remediation marsh habitat from COCs in underlying sediment or residuals. Alternative UPIC3-A includes a thin-layer cover over a relatively small portion of the marsh near the existing radio towers. The thin-layer cover provides long-term effectiveness in this area since this portion of the marsh is located on the southern portion of UPIC in an area that has generally lower COC concentrations than the rest of UPIC marsh and is not adjacent to the UPIC waterways and not subject to erosive forces. Alternative UPIC3-A would provide a high degree of long-term effectiveness while avoiding negative impacts to the radio towers and infrastructure on the southern portion of UPIC marsh. For these reasons, there is no meaningful difference in ecological exposure risk reduction between Alternatives UPIC3, UPIC3-A, and UPIC4.

Reduction of Toxicity, Mobility, or Volume through Treatment: The same relative rating was given for the "treatment" balancing criterion to all alternatives involving marsh sediment excavation, for the same reasons as described for the waterway remedial alternatives that involved dredging. As Alternative UPIC2 would not involve a sediment excavation component, and hence would not incorporate any sediment treatment component, it was given a low rating with respect to the treatment balancing criterion.

Short-Term Effectiveness: Alternative UPIC2 is given a high short-term effectiveness rating due to the fewer community impacts and construction worker risks, shortest construction duration, absence of a marsh excavation remedy component, and lesser challenges in re-establishing the marsh vegetation compared to the other marsh alternatives. The ratings for Alternatives UPIC3, UPIC3-A, and UPIC4 recognize that there would be short-term impacts associated with the marsh excavation and backfilling operations, including temporary loss of habitat, but that these impacts would be limited and manageable. Habitat will re-establish itself naturally following the completion of remedial activities. Because the remedial action would improve and replace existing habitat, no additional compensatory mitigation measures would be necessary. Alternative UPIC3 is rated moderate to high and Alternative UPIC4 is rated moderate in recognition of the larger sediment excavation and backfill volumes and the concomitant greater impacts related to construction duration, truck trips, noise, potential odors, water management, and other factors associated with these operations. Given the relative ratings for Alternative UPIC2 (high) and UPIC3 (moderate to high), and the fact that approximately 86.5% of UPIC marsh would undergo excavation and backfill with Alternative UPIC3-A, this latter alternative is given a short-term effectiveness rating of moderate to high.

Implementability: Alternative UPIC2 is given a high implementability rating as technical and construction implementation challenges would be minor and it would not involve excavation activities around the eight radio towers present in the marsh, which simplifies implementation. While Alternative UPIC3 would have a sediment excavation and management component, it is given a moderate to high implementability rating due to the limited depth of excavation and the relative accessibility of the marsh. Alternative UPIC4 is given a moderate implementability rating in that no significant administrative challenges are anticipated, but it would have twice the volume of sediment to manage, twice the amount of backfill to place, and more substantial sediment management, water treatment, odor control, and other requirements compared to Alternative UPIC3. In the case of Alternatives UPIC3 and UPIC4, the alternatives assume that all 28.2 acres of the UPIC marsh can be excavated, including contaminated sediments in the radio tower area (covering approximately 7 acres of the 28.2-acre UPIC marsh); however, working around the radio towers poses several implementability challenges. It is questionable whether the structural stability of the radio towers can be maintained during excavation, and temporary or permanent relocation of the towers poses to allow for full excavation poses a number of administrative challenges. These issues led to the consideration of thin-layer capping of about 3.8 acres of the 7 acres that are directly under the structural footprint of the radio towers, as part of the hybrid alternative, UPIC3-A. Implementation of Alternative UPIC3-A would be much like that of Alternative UPIC3 across much of the marsh. Importantly, however, Alternative UPIC3-A would not involve excavation in 3.8 acres of the radio tower area, which simplifies implementation. For this reason, Alternative UPIC3-A is given a high implementability rating.

Cost: A summary of the FS-level cost estimates for Alternatives UPIC2 to UPIC4 is presented in Table 3. Alternative UPIC2 is the least expensive of the alternatives. Alternative UPIC4 has the highest overall cost: about 39% higher than Alternative UPIC3, 48% higher than Alternative UPIC3-A, and nearly 350% higher than Alternative UPIC2. Alternative UPIC3-A is a little more than double the cost of Alternative UPIC2, while Alternative UPIC3 is about two and one-half times the cost of Alternative UPIC2.

State Acceptance:

This plan is under review by the New Jersey Department of Environmental Protection.

Community Acceptance:

Community acceptance of the preferred alternative will be evaluated after the public comment period ends.

SUMMARY OF PREFERRED ALTERNATIVE

EPA's preferred alternative for the Phase 1 interim remedial action for the BCSA waterways and UPIC marsh are summarized below.

UBC and MBC Waterways: *Alternative W4: 2-foot Sediment Removal + Backfill/Cap*

This alternative includes the following primary components:

- Bank-to-bank removal of 2 feet of soft sediment within the proposed remediation footprint (plus 6 inches of over-dredge). Where less than 2 feet of soft sediment is present, the soft sediment removal thickness will be the soft-sediment thickness. This alternative is expected to remove approximately 363,000 yd^3 of sediment from the UBC and MBC waterways.

- Backfill/capping of the areas where sediment is removed. The backfill thickness will be equal to the thickness of sediment removed. In areas where contaminated soft sediment remains below the excavation depth, the backfill will serve as a cap to physically isolate this material. The work will include mitigation of habitat disturbed by the remedial action.

- Institutional controls would be necessary for both the waterways and the UPIC Marsh. ICs would include; continuing fish consumption advisories in order to reduce the risk from consumption of fish and crabs from within BCSA waters, as well as use restrictions to prevent disturbance of the sand caps.

- A Marsh Demonstration project, which will provide information relating to the effectiveness of the sediment remedy in controlling deposition of contamination on the marshes, as well as provide information to evaluate alternatives for the next phase(s) of remediation.

- Monitoring of the system response to the selected remedy in the areas of active remediation, the marshes, and the downstream study segments. Marsh Demonstration Project areas will also be monitored as part of the Phase 1 monitoring program to be conducted as part of the remedial action.

This alternative provides source control through removal of soft sediment to a depth of up to 2 feet (plus 6 inches of over-dredge), which includes the current source material and placement of a backfill/cap layer (of the same thickness as the total dredging depth) that physically isolates underlying sediments and provides more than sufficient separation distance between the new, post-remediation BAZ and underlying soft sediment through a stable and robust backfill/cap layer.

UPIC Marsh: *Alternative UPIC3-A: Hybrid – Sediment Removal + Backfill and Thin-Layer Cover*

This alternative includes the following components:

- Removal of marsh sediments to a depth of 1 foot, with removal of 2 feet of sediment within a 10-foot strip along the marsh edge at the waterway banks. This alternative is expected to remove approximately 69,500 yd^3 of UPIC marsh sediment.

- The excavated sediment will be replaced with backfill to maintain marsh surface elevations, isolate underlying marsh sediment, and re-establish the marsh habitat.

- In lieu of excavation, a 6-inch thick cover of clean material will be placed over the existing marsh in the area surrounding the radio towers in the southern portion of UPIC marsh. Approximately 3,600 yd^3 of thin-layer cover material will be placed.

- Monitoring of the system response to the selected remedy in the waterways and marsh.

This alternative provides source control by removing the sediment with the highest COC concentrations within the excavation footprint. Backfill placed in the excavation areas will isolate underlying marsh sediment and facilitate reestablishment of the marsh habitat. The thin-layer cover in the radio tower area will isolate the underlying sediments and provide additional stability and protectiveness without disturbance of the existing radio tower structures and infrastructure.

Selection of the preferred alternative was accomplished through evaluation of the seven threshold and balancing remedy selection criteria as specified in the NCP. The preferred alternative meets the threshold criteria and provides the best balance of tradeoffs relative to the other alternatives with respect to the balancing and modifying criteria. It will satisfy the following statutory requirements of CERCLA 121(b): (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the statutory preference for treatment as a principal element to the extent practicable. EPA's preferred alternative is under review by the New Jersey Department of Environmental Protection.

W4 and UPIC3-A together comprise the preferred alternative. The preferred alternative was selected over the other alternatives because this is the best tradeoff of risk reduction, long term operation and maintenance requirements, and maintaining stability of marshes. The preferred alternative will provide for long-term control of sources of COCs and will achieve the RAOs established for the Phase 1 remedy.

Overall, the preferred alternative for the UBC and MBC waterways and UPIC marsh includes active remediation of approximately 87.2 acres of waterway and 28.2 acres of marsh. The preferred alternative is expected to remove approximately 432,000 yd^3 (W4: 363,000 yd^3 + UPIC3-A: 69,000 $yd^{3)}$ of contaminated sediments from the BCSA. The total estimated cost of the remedy is $332 million (W4: $261 million + UPIC3-A: $58 million + Marsh Demonstration Project: $13 million). The preferred alternative will achieve the Phase 1 RAOs, control sources of COCs within the BCSA, and protect human health and the environment.

It is estimated that the preferred alternative will take approximately two years to design after the ROD is signed. The estimated time for construction is approximately 3.5 years. Post-construction effectiveness monitoring will take approximately 5 years following completion of the remedy. Subsequent risk assessments and Supplemental Feasibility Study efforts will then be conducted. Therefore, it is likely to take approximately 11 years after the ROD is signed until the determination for the next phase of work is presented.

COMMUNITY OUTREACH CONSIDERATIONS

The EPA has engaged with key stakeholder groups prior to the development of the Proposed Plan. EPA has held several availability sessions over the course of the RI/FS, although participation was limited. A series of briefings was held, one for each of the communities bordering Berry's Creek, Bergen County, the business community (organized through the Meadowlands Chamber of Commerce, the New Jersey Sports and Exhibition Authority (NJSEA), as well as Hackensack Riverkeeper/Baykeeper. Public comment on the Proposed Plan will be accepted during the public comment period. EPA will provide additional information regarding the proposed cleanup of the BCSA via a public meeting, access to the Administrative Record, announcements published in the local newspapers and access to a website for the BCSA (http://www.epa.gov/superfund/ventron-velsicol).

These activities will:

- Help the public to understand the alternatives presented in the Proposed Plan, including the Preferred Alternative, and EPA's evaluation criteria so that the public can effectively provide input on the Proposed Plan; and

- Make the public aware of the full range of opportunities to learn about the Proposed Plan and how to provide input.

EPA is committed to maintaining a transparent proactive community interaction process during each cleanup phase.

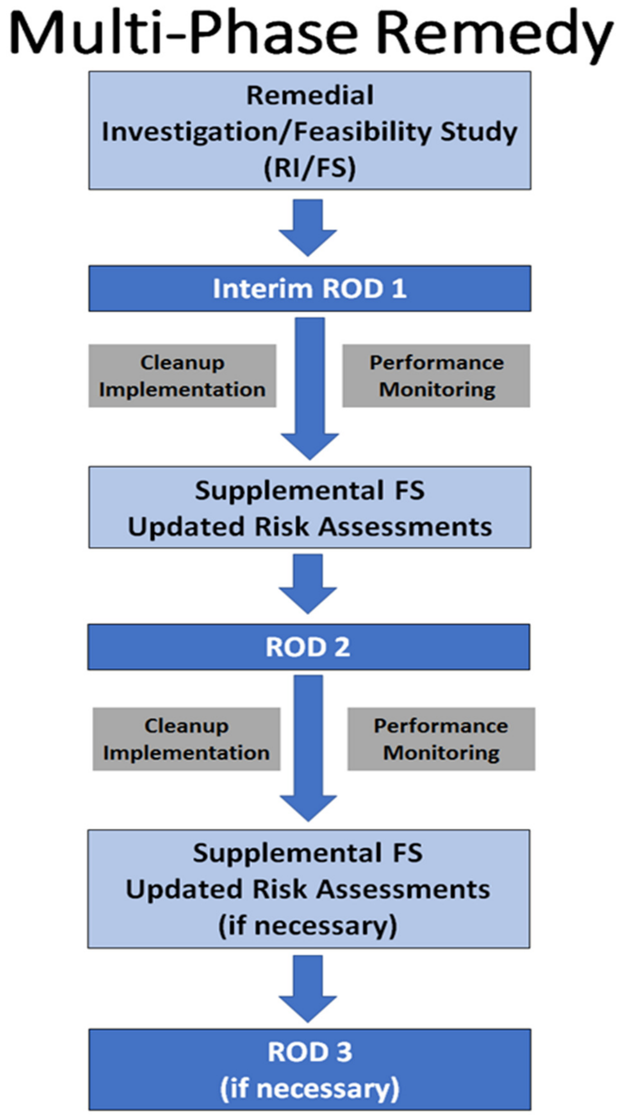

Figure 10. Illustration of RI/FS Process and Multi-Phase Remedy Process for the BCSA

FOR FURTHER INFORMATION
The administrative record file, which contains the supporting documentation for the Proposed Plan, can be viewed at the information repositories:

Wood-Ridge Memorial Library
231 Hackensack Street
Wood-Ridge, NJ 07075
PH: (201)438-2455

USEPA Records Center
290 Broadway -18th floor
New York, NY 10007
PH: (212) 637-4308

Also available at:

EPA's website: www.epa.gov/superfund/ventron-velsicol